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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|----------------------------|-------------|----------------------|---------------------|------------------|
| 10/809,974 | 03/26/2004 | Shang-Chih Chen | 67,200-1258 | 7904 |
| 7590 04/25/2005 | | | EXAMINER | |
| TUNG & ASSOCIATES | | | QUACH, TUAN N | |
| Suite 120 | | | ART UNIT | |
| 838 W. Long Lake Road | | | PAPER NUMBER | |
| Bloomfield Hills, MI 48302 | | | 2826 | |

DATE MAILED: 04/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

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|------------------------------|-------------------------------|-----------------------------|--|
| Office Action Summary | Application No. 10/809,974 | Applicant(s) CHEN ET AL. | |
| | Examiner Tuan Quach | Art Unit 2826 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 March 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) 1-21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 22-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Applicant's election with traverse of claims 22-40 in the reply filed on March 14, 2005 is acknowledged. The traversal is on the ground(s) that the process step using a sacrificial gate pattern is not possible. This is not found persuasive since the bare allegation of impossibility is not supported by any evidence; it remains a sacrificial masking can be employed wherein the gate pattern can be formed by sacrificial masking wherein lithography and patterning is done on the sacrificial masking layer rather than on the gate layer. Furthermore, the product as claimed can still be made by yet another materially different process wherein the gate electrode layer is formed on a carrying substrate, followed by forming the buffer dielectric, the high k dielectric, and the semiconductor layer substrate thereon, followed by removal of the carrying substrate.

The requirement is still deemed proper and is therefore made FINAL.

Claims 23-40 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

These claims erroneously were written as directly or indirectly depending from claim 21. In view of the leading independent claim being claim 22, it is assumed that applicant made an error and intended these claims to depend from claim 22, i.e., in claims 23-31 and 36-40, the preamble would read "The gate structure of claim 22". If applicant truly intended these product claims to depend from claim 21, then all the

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process steps of claim 21 (including those of base claim need to be incorporated into these claims. Correction is required.

In claim 26, "the interfacial layer" lacks antecedent basis; this claim should depend from claim 25. In claim 30, "the dopant concentration" lacks antecedent basis.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

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consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 22-26, 28, 29, 39, 40 rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Parker et al.

Regarding claim 22, Parker et al. 6,787,440 B2 teach a buffer layer 105 and a high-k dielectric layer 110 under gate 120 wherein the buffer can be either below or above the high-k dielectric, column 2 line 55 to column 4 line 55, wherein the buffer 210 is formed on the high-k dielectric 205 followed by formation of gate layer 220. Note the limitation recited in claim 22 regarding the buffer layer comprising dopants selected from the group consisting of a metal, a semiconductor, and nitrogen would be met or anticipated by the teaching in Parker et al., column 2 lines 34-38 and wherein reduced voltage threshold, e.g., claim 22 preamble, claims 23 and 24, would follow or alternatively obvious, absent evidence to the contrary as the buffer dielectric including the material claimed is employed, e.g., as in claim 28, 29, silicon oxynitride, silicon dioxides and suitable materials, e.g, column 2 lines 35-38 supra, are employed.

Regarding claims 39 and 40, the various high k dielectric enumerated in these claims are met given the teachings in Parket et al., column 2 lines 55-63. Alternatively, official notice is given regarding any suitable materials enumerated in the claims and not delineated in the reference.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Parker et al. taken with either Dimmler et al.

Regarding claim 27, Parker et al. is applied above but does not explicitly recite the dielectric constant value claimed. Dimmler et al. 2004/0057319 A1 teach buffer dielectric including high dielectric constant. See [0035], claims 8-11.

It would have been obvious to have selected the desired dielectric constant since such is conventional and advantageous as evidenced by Dimmler et al.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Parker et al. in view of Tseng et al.

Parker et al. is applied as above and does not recite the decreasing concentration.

Tseng et al. 5,464,792 teaches buffer layer including decreasing concentration to improve integrity and durability of the underlying dielectric 14. See the abstract, column 2 line 51 to column 5 line 15.

It would have been obvious to one skilled in the art in practicing the above invention to have included the concentration gradient as delineated since such is conventional and advantageous as evidenced by Tseng et al.

Claims 31-35 and rejected under 35 U.S.C. 103(a) as being unpatentable over Parker et al. taken with Nishikawa et al. or Dimmler et al. and Kim et al. or Xiang.

Parker et al. is applied as above and does not explicitly recite metals dopant.

Nishikawa et al. 2004/0096692, [173], teaches the inclusion of metal dopants, e.g., Ce, in the buffer layer wherein high dielectric constant buffer layer can be obtained.

Dimmler et al. 2004/0057319 A1 also teaches buffer dielectric employing high dielectric constant materials thus permitting the desired dielectric constant.

Kim et al. 6,727,130 teaches the various high dielectric constant materials including dielectric materials such Al_2O_3 , HfSiO_2 can be employed in gate insulating layer including formation in PMOS and NMOS devices. See column 56 lines 62 to column 6 line 18.

Xiang 6,734,527 teaches CMOS devices including gate materials such as hafnium silicates, aluminum oxide and their applications in MOS devices including NMOS and PMOS devices. See column 4 lines 7 to column 6 line 37.

It would have been obvious to one skilled in the art to have included metal dopants in the above invention since such is conventional and advantageous as evidenced by Nishikawa et al. and Dimmler et al. to obtain desired high dielectric constant and to take advantage of the conventional high dielectric constant materials including metal dopants delineated in Kimm et al. and Xiang. It would have been obvious and would have been a matter of routine optimization to select the appropriate dopant amounts as in claim 33. Regarding claim 34 and 35, the selection of desired metals would have been conventional and obvious given the materials delineated above in Nishikawa et al., Kim et al., and Xiang; additionally, it would have been obvious and within the purview of one skilled in the art to have selected the suitable equivalent materials enumerated in claim 34.

It would have been obvious to have employed such dielectric materials including hafnium oxide and aluminum oxide as in claims 35-38 in the dielectric materials since such is conventional and advantageous including obtaining high dielectric constant for the buffer dielectric since such corresponds to well known high dielectric materials and

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wherein the use of buffer including high dielectric constant materials is conventional and advantageous as shown in Dimmler et al. above. It would have been obvious and would have been within the purview to one skilled in the art to have employed such materials to form NMOS and PMOS devices, respectively, e.g., as in claims 36, 37, since such applications are well known and obvious as evidenced by Kim et al. and Xiang as delineated above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number is (571) 272-1717. The examiner can normally be reached on M - F from 8:30 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Nathan Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272-1562.



Tuan Quach
Primary Examiner